2011 Chemistry Midterm Review

Unit 1: Alchemy (Lessons 1-26); Smells Lessons 1-6

Name: KEY

Date: Pd:

In order to study for the test, you should:

- ✓ Review all classroom outlines
- ✓ Review all vocabulary terms which are located at the end of each lesson in a list
- ✓ Look over all activity worksheets done for all lessons
- ✓ Read the lesson summaries found at the end of each lesson
- ✓ Review quizzes and homework assignments for all lessons

A periodic table will be provided. Calculators will not be needed/permitted.

The following are some sample review questions for each lesson. This worksheet is a selected review and does NOT cover all material for the test. Also, be aware that you should review the concepts learned in these lessons but will also be required to apply this knowledge on the test.

LESSON 1: Lab Equipment & Safety

1. List 3 pieces of lab safety equipment in the classroom and their uses.

(Answers will vary) Examples: eye wash, safety shower, fire blanket, broken glass container, goggles, apron (describe their uses)

2. Sketch a picture and describe the use of:

a) flask

mix solutions
perform reaction

b) ring stand

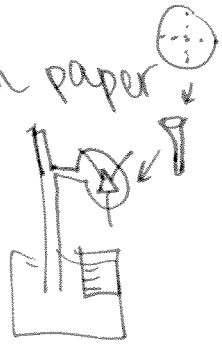
hold lab equipment in place

c) graduated cylinder

accurately measure volumes of liquids

3. Draw and describe the setup used to separate a solid from a liquid in a *filtration*.

* Ring stand, triangle, funnel, filter paper goes on stand; beaker below
* Pour solution through funnel. Liquid flow through, solid in paper



LESSON 2: Introduction to Chemistry & Penny Lab

4. How did alchemists contribute to the modern study of chemistry? What is chemistry?

- Developed lab tools and chemistry techniques
- classified substances
- study of matter & its properties/changes

5. In the Penny for your Thoughts Lab, what observations did you note about the appearance of the penny? Did we turn the penny into a precious metal?

- Penny changed colors from copper to silver to gold.
- No, only changed appearance, made brass, not gold

LESSON 3: Defining Matter

6. List 3 examples of matter and 3 examples of things that are not matter.

Answers Will Vary : Yes: desks, people, elements, compounds
No: ideas, energy, feelings

7. In order to be classified as matter, a substance must have both mass & volume

8. Classify each of the following as matter or not matter:

a. air : Matter
b. sound : Not Matter
c. dust : Matter
d. atoms : Matter
e. helium : Matter
f. electricity : ~~Electricity~~ Not
g. happiness : Not
h. bacteria : Matter

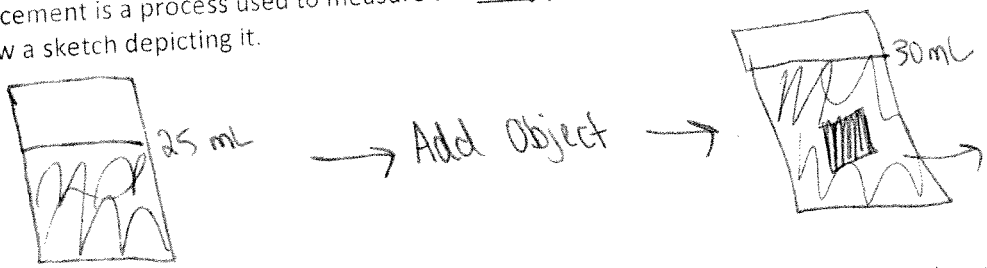
LESSON 4: Mass and Volume

9. a) How is mass measured? What units are used for mass? Balance : ex. g, mg, kg, lb

b) How is volume measured? What units are used for volume?

calculated or w/ graduated cylinder : mL, L, cm^3, m^3

10. Water displacement is a process used to measure the Volume of an object. Explain this process and draw a sketch depicting it.



Volume Rises. Differen in H_2O is Vol of S

11. a) A graduated cylinder contains 50.0 mL of water. A piece of metal is placed in the cylinder and the water level rises to 72.0 mL. What is the volume of the object in mL? In cm^3?

$V = 72 - 50 = \boxed{22\ mL} = \boxed{22\ cm^3}$

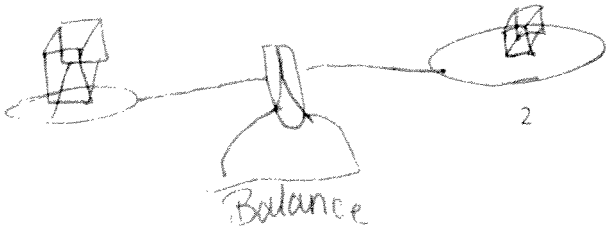
$1\ mL = 1\ cm^3$

b) Calculate the volume of a rectangular object with the dimensions of 2.5 cm x 4.5 cm x 4.0 cm

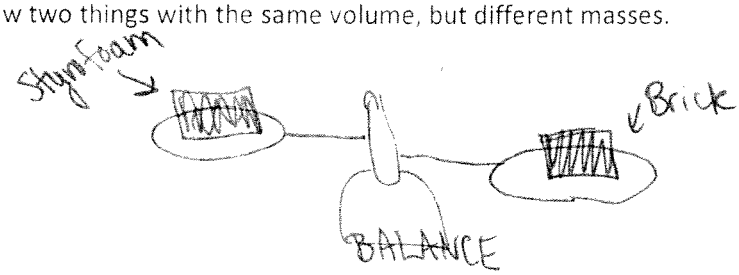
$V = 2.5 \times 4.5 \times 4.0$

$= \boxed{45\ cm^3}$

12. Draw two things with the same mass, but different volumes.



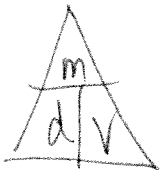
13. Draw two things with the same volume, but different masses.



LESSON 5: Density

14. The definition and formula for density are:

Density is mass per unit volume. $D = \frac{m}{V}$



15. Density is an *intensive property*. What does this mean?

The property does not change depending on the size or shape of the sample. It can be used to identify a substance.
ex Gold brick and gold ring will have same density.

16. Calculate the density of an object with a mass of 18 g and a volume of 4.5 mL.

$d = \frac{m}{V}$ $d = \frac{18\ g}{4.5\ mL} = \boxed{4\ g/mL}$

17. What is the volume of a metal object with a density of 11.4 g/cm^3 and a mass of 17 g? Use page 19 to determine the identity of the metal.

$V = \frac{m}{d} = \frac{17\ g}{11.4\ g/cm^3} = \boxed{1.49\ cm^3 \text{ is the volume}}$

Density of 11.4 $\frac{g}{cm^3}$ indicates Lead

18. What is the density of a brass brick? What is the density of a brass ring?

Any brass object is 8.4 g/cm^3 (Pg. 19)

LESSON 6: Chemical Names & Symbols

19. Describe the difference between an element and a compound. Provide an example of each.

Element is just one type of atom. (ex. gold or hydrogen)
Compound is 2 or more elements combined (ex. NaCl, H_2O, $Al(OH)_3$)

20. List the information provided by: $NaNO_3(s)$

- Contains Na, N, and 3 O atoms
- Solid
- metal and nonmetal atoms
- ionic

21. What is the difference between LiCl*(s)* and LiCl*(aq)*?

One is a solid ionic compound (s) and the other is aqueous (aq) so it's dissolved in water

LESSON 7: The Copper Cycle

22. List the copper compounds (names & formulas) formed in each step of the copper cycle:

a) Solid copper powder was obtained: copper : Cu(s)

b) Nitric acid, HNO_3*(aq)*, was added: Copper(II) nitrate : $Cu(NO_3)_2$ (aq)

c) Sodium hydroxide, NaOH*(aq)*, was added: copper (II) hydroxide: $Cu(OH)_2$ (s)

d) The solution was heated and filtered: copper (II) oxide : CuO (s)

e) Sulfuric acid, H_2SO_4*(aq)*, was added: copper (II) sulfate : $CuSO_4$ (aq)

23. What are some observations that indicate that a chemical change has occurred?

Color change, bubbling, formation of a precipitate

24. Why is adding nitric acid to copper a chemical reaction but a puddle evaporating is not?

The first changes the chemical identity of the substance from Cu to $Cu(NO_3)_2$ while evaporating only changes the state of matter w/out changing the chemical formula

LESSON 8: Conservation of Matter

25. How did the copper cycle lab show the law of conservation of matter? What is the law of conservation of matter?

- Cu atoms were present throughout the entire cycle
- Law states that in a chemical reaction, matter cannot be created or destroyed.

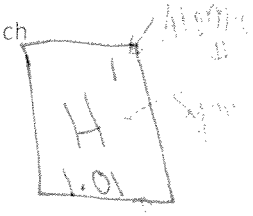
LESSON 9: Properties of the Elements

26. How did Mendeleev organize his periodic table?

He grouped elements with similar reactivity and ordered the elements by their atomic weights

27. On a basic periodic table (like the one in our classroom), what information is provided in each element square?

Symbol, Atomic #, Atomic Mass ex.



28. Magnesium reacts with chlorine to form $MgCl_2$. How will strontium react with chlorine? How do you know?

It will form $SrCl_2$. Elements in the same group have similar properties like reactivity

LESSON 10: The Periodic Table

29. What is the main difference between the organization of the modern periodic table and Mendeleev's periodic table?

Mendeleev: organized by atomic weight

Modern: organized by atomic #

30. What are the names of Groups 1, 2, 17, and 18, respectively?

1: alkali metals

2: alkaline-earth metals

17: halogens

18: noble gases

31. On the periodic table, be sure to know the location of:

atomic number	group	period
average atomic mass	metals	nonmetals
metalloids	alkali metals	noble gases
alkaline earth metals	halogens	transition metals
lanthanides	actinides	main group elements

LESSON 11: Models of the Atom

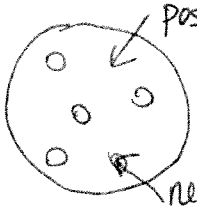
32. Sketch , name, and describe the main features of each scientist's model of the atom:

a. Dalton

Solid Sphere

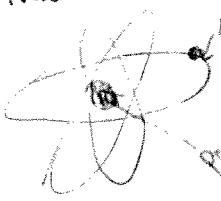
indivisible Sphere

b. Thomson Plum Pudding



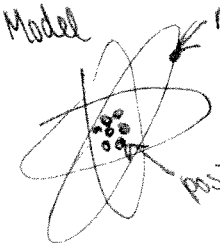
c. Rutherford

Nuclear Model



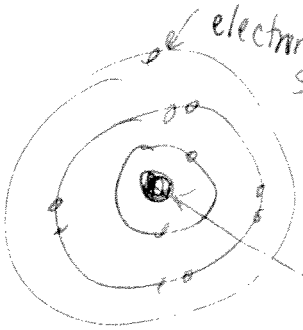
d. Rutherford

Proton Model

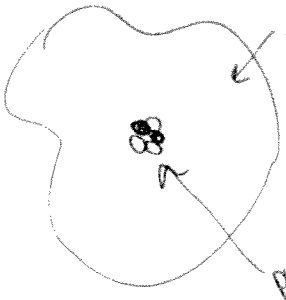


e. Bohr

Solar System Model



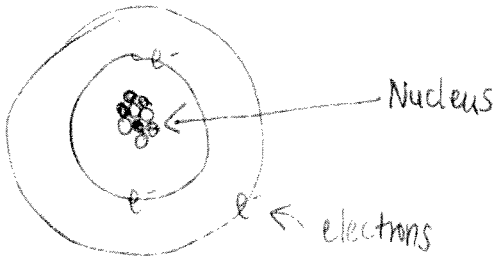
f. Heisenberg, Chadwick



33. Why did the model of the atom change over time?

New experiments gave evidence that didn't fit current models so the models changed to reflect the new info.

34. Draw and describe the simple atomic model. What are the charges of the subatomic particles?



protons: +

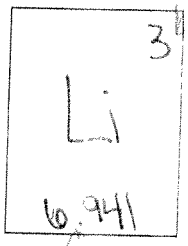
neutrons: 0

electrons: −

LESSON 12: Atomic Number and Atomic Mass

35. Atomic number is the # of protons in an atom and determines an atom's identity.

36.



a. Fill in this block, showing the information from the periodic table for lithium.

b. How many protons are in an atom of lithium? 3

c. What is lithium's atomic number? 3

d. How many protons, neutrons, and electrons are in a neutral lithium atom?

1) Atomic # = 3 = 3 protons

2) Mass # = 7 so 7 − 3 = 4 neutrons

3) Neutral atom has 3 electron to balance out the protons

37. Complete the following table using a periodic table.

Element	Symbol	Atomic Number	Number of Protons	Number of Electrons	Number of Neutrons	Average Atomic Mass
vanadium	V	23	23	23	(51 − 23 = 28) 28	50.942
chlorine ion	Cl^-	17	17	18	(35 − 17 = 18) 18	35.453
Phosphorus	P	15	15	15	(31 − 15 = 16) 16	30.974

LESSON 11: Models of the Atom

38. What are the major features and scientists associated with:

a. Solid Sphere Model b. Plum Pudding Model c. Nuclear Model

d. Solar System Model e. Proton Model f. Electron Cloud Model

39. Sketch and label the simple atomic model that is used today.

LESSON 12: Atomic Number and Atomic Mass

40. What is the definition of atomic number? Where is it located on the periodic table?

# of protons; whole number listed for the element

41. Name the element:

a. atomic number 40 zirconium b. contains 12 protons magnesium

42. Name the atomic number:

a. iron: 26 b. barium 56 c. krypton 36

43. What are the atomic masses (in units of amu) of the two subatomic particles found in the nucleus?

Protons and neutrons are both about 1 amu (atomic mass unit)

44. Use the periodic table to estimate the atomic masses of germanium, cobalt, and fluorine. Ge: 73 amu ; Co: 59 amu ; F: 19 amu

45. a. What is the average atomic mass listed on the periodic table for sodium? (Include all decimals)

22.98977 amu

b. What is the most common isotope of sodium: sodium-22 or sodium-23. Why?

Sodium-23 because the weighted average is closer to 23

LESSON 13: Isotopes

46. Chlorine exists as two isotopes. Chlorine is 76% chlorine-35 and 24% chlorine-37. Determine the average atomic mass of chlorine. (You are calculating a *weighted average* here).

Method # 1: $\frac{(76 \times 35) + (24 \times 37)}{100} = 35.48$ amu

METHOD 2

$(.76 \times 35) + (.24 \times 37)$

35.48 amu

47. How many protons and neutrons are in an atom of bromine-80?

35 protons and 45 neutrons

48. What is the atomic number of an atom with 15 protons? What is the mass number of an atom with 15 protons and 16 neutrons?

Atomic # = # protons = 15

Mass # = protons + neutrons = 15 + 16 = 31

LESSON 14: Stable and Radioactive Isotopes

49. Are radioactive isotopes stable or unstable? Why?

Unstable : Nucleus has unstable ratio of protons to neutrons

50. The ratio of protons to neutrons in an atom determines its stability.

51. Complete the following table: *(Use the periodic table for atomic numbers and element names/symbols only. Remember the mass on the periodic table is a weighted average atomic mass for all isotopes of an element.... whereas this table is referring to a single atom of an element.)*

Isotope Name	sotope symbol	Atomic #	# of Protons	# of Neutrons	Mass #	# of Electrons
lead-207	$^{207}_{82}Pb$	82	82	125	207	82
Zirconium-91	$^{91}_{40}Zr$	40	40	51	91	40
cadmium-113	$^{113}_{48}Cd$	48	48	65	113	48

LESSON 15: Nuclear Reactions and LESSON 16: Formation of Elements

52. Write a nuclear equation showing each of the following isotopes emitting a beta particle.

a. potassium-42

$^{42}_{19}K \rightarrow ^{0}_{-1}B + ^{42}_{20}Ca$

PARENT DAUGHTER

b. barium-136

PARENT $^{136}_{56}Ba \rightarrow ^{0}_{-1}B + ^{136}_{57}La$

53. Label the parent isotope and daughter isotope in Question 52. DAUGHTER

54. Write a nuclear equation showing each of the following isotopes emitting an alpha particle.

a. platinum-180

$^{180}_{78}Pt \rightarrow ^{4}_{2}He + ^{176}_{76}Os$

b. bismuth-205

$^{205}_{83}Bi \rightarrow ^{4}_{2}\alpha + ^{201}_{81}Tl$

55. a. What are the symbols for alpha, beta, and gamma radiation?

$^{4}_{2}He$ or $^{4}_{2}\alpha$ $^{0}_{-1}B$ or $^{0}_{-1}e$ $^{0}_{0}\gamma$

b. Which is the most harmful and why?

Gamma rays due to their very high energy

c. Gamma radiation often accompanies the processes of: *Circle all that apply*

i. alpha decay iii. fission

ii. beta decay iv. fusion

56. The splitting apart of a nucleus is called fission. Where does this process occur? Nuclear Power Plant

57. The joining of nuclei to form a larger nucleus is called fusion. Where does this process occur? Sun

58. Suppose holmium-170 undergoes beta decay. The daughter isotope then also undergoes beta decay. What is the final product?

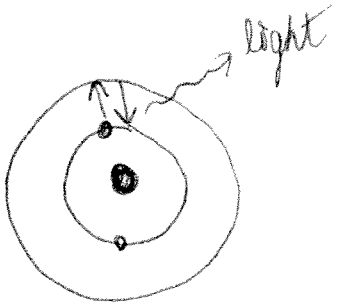
① $^{170}_{67}Ho \rightarrow ^{0}_{-1}B + ^{170}_{68}Er$ ② $^{170}_{68}Er \rightarrow ^{0}_{-1}B + ^{170}_{69}Tm$ Final Product

59. The only way to change one element into another is to change the number of protons in the nucleus.

LESSON 17: TECHNICOLOR ATOMS – Flame Tests

60. What was responsible for the different flame colors in this lab? (Try to draw a picture to describe movement of electrons in the atom and how this produces different colors.)

Electrons get excited by heat and jump out to a higher energy electron shell. When they fall back down a photon of light is emitted



LESSON 18: Valence and Core Electrons

61. What is the difference between valence and core electrons?

Valence e^- are in the outermost shell

62. In terms of electrons, what do fluorine, chlorine, and bromine have in common?

They all have 7 valence electrons

63. Why do elements in the same group have similar properties?

They have the same # of valence e^-

64. How many valence and core electrons are in a neutral atom of:

a. magnesium	b. oxygen	c. bromine
2 valence	6 valence	7 valence
10 core	2 core	28 core

LESSON 19: Ions

65. Which noble gas do each of the following elements want to be like? Why do elements want to "be like the noble gases"? They are stable with a full valence shell

a. sodium	b. calcium	d. aluminum	e. oxygen
Ne	Ar	Ne	Ne

66. For each of the following elements, state whether the atom has to gain or lose electrons, the formula of the ion, and whether the ion is a cation or an anion.

a. beryllium	b. nitrogen	c. sulfur
lose 2 e^-	gain 3 e^-	gain 2 e^-
Be^{2+}	N^{3-}	S^{2-}
cation	anion	anion

67. How many protons, neutrons, and electrons are in:

a) Cl^-

From Periodic Table { Atomic # = 17 = (17 p+)
Mass = 35 (protons + neutrons)
so 35 - 17 = (18 n°)

Charge is -1 so (18 e-)

b. Mg^{2+}

12 protons
10 electrons
12 neutrons

LESSON 20, 21, 22, & 23: Ionic Compounds, Formulas for Ionic Compounds, Polyatomic Ions, and Transition Metals

68. What is an ionic compound?

Compound composed of metal cations and nonmetal anions so that the charges add up to zero

69. How do the charges add up to zero in $CaCl_2$?

Ca^{2+} Cl^- Cl^- $(+2) + (-1) + (-1) = 0$

70. Write the formula of the ionic compound forming between sodium and oxygen ions.

Na^+ O^{2-}
Na^+ $\Rightarrow$ Na_2O

71. Write the names of:

a. KCl — potassium chloride

b. $NaNO_3$ — sodium nitrate

c. MgO — magnesium oxide

d. Li_2SO_4 — lithium sulfate

e. $CoBr_2$ — cobalt(II) bromide

72. Write the formulas of:

a. potassium hydroxide — $\boxed{KOH}$ (K^+ and OH^-)

b. aluminum sulfide — $\boxed{Al_2S_3}$ (Al^{3+} and S^{2-})

c. sodium fluoride — $\boxed{NaF}$ (Na^+ and F^-)

d. calcium oxide — $\boxed{CaO}$ (Ca^{2+} and O^{2-})

e. iron(III) chloride — $\boxed{FeCl_3}$ (Fe^{3+} and Cl^-)

f. barium nitride — $\boxed{Ba_3N_2}$ (Ba^{2+} and N^{3-})

73. Write the cation and ion in:

a. lithium oxide — Li^+ and O^{2-}

b. $Mn(OH)_2$ — Mn^{2+} and OH^-

c. Al_2O_3 — Al^{3+} and O^{2-}

d. Cu_2CO_3 — Cu^+ and CO_3^{2-}

e. magnesium phosphate — Mg^{2+} and PO_4^{3-}

f. $MgBr_2$ — Mg^{2+} and Br^-

LESSON 24: Electron Configurations

74. How many subshells are there, their respective names, and how many electrons can each hold?

- 4 subshells
- "s" (can hold 2 e⁻)
- p (can hold 6 e⁻)
- d (can hold 10 e⁻)
- f (can hold 14 e⁻)

75. Write longhand and shorthand electron configurations for:

a. lithium

$1s^2 2s^1$

[He] $2s^1$

b. copper

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^9$

[Ar] $4s^2 3d^9$

c. sulfur

$1s^2 2s^2 2p^6 3s^2 3p^4$

[Ne] $3s^2 3p^4$

LESSON 25 & 26: **Classifying Substances and Bonding**

76. What type of bonding exists between:

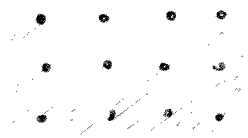
a. metals metallic

b. nonmetals network covalent or molecular covalent

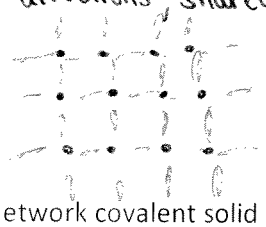
c. metals with nonmetals ionic

77. Describe the location of electrons in each type of bonding. Sketch a picture to describe each.

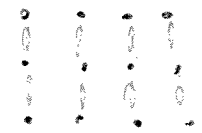
Metallic:
e- freely moving through whole substance



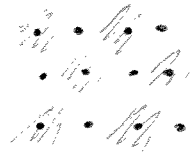
Network Covalent:
e- pairs bonding in all directions; shared e-



Molecular Covalent:
e- pairs shared in small clusters



Ionic:
e- transferred from metal to nonmetal



78. Use bonding to explain why a network covalent solid will not dissolve while a molecular covalent solid will dissolve.

Network: Atoms too tightly bound by bonded pairs in all directions so can't break up atoms

Molecular: Bonded in clusters so H_2O can get between to break up

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SMELLS – UNIT 2

LESSON 1: Molecular Formulas

1. Predict the smells of these molecules. Explain your reasoning.

a. hexylamine, $C_6H_{15}N$ Fishy (N and "amine")

b. pentyl acetate, $C_7H_{14}O_2$ Sweet (O_2, ends in -ate, 2x H as C)

c. acetic acid, $C_2H_4O_2$

putrid (O_2, end in "-ic acid")

2. What is similar about the molecular formulas of each type of smell:

a. minty

one oxygen

(Ketone)

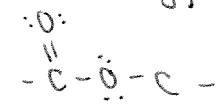
b. fishy

nitrogen

(amine)

c. sweet

two oxygen

 (ester)

3. What is similar about the names of each type of smell:

a. minty

ends in "-one"

b. fishy

has "amine"

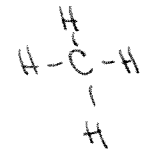
c. sweet

ends in "-yl -ate"

LESSON 2: Structural formulas

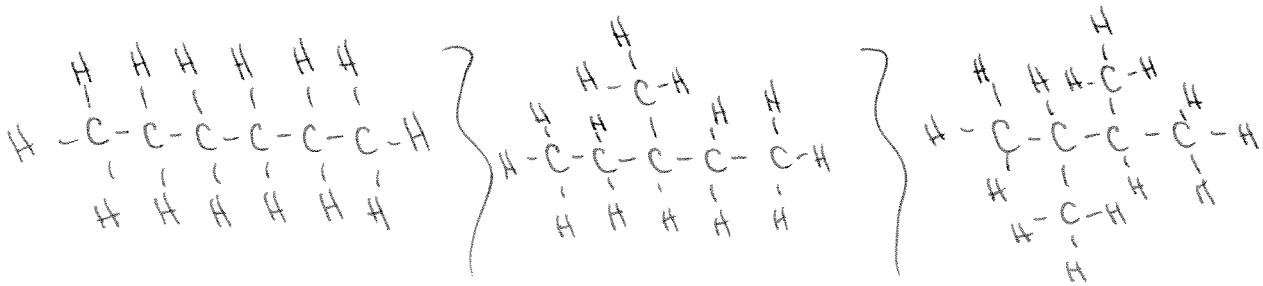
4. What is the difference between a molecular formula and a structural formula? Which type provides more information?

Molecular: type of atoms and # of each; example CH_4

more info → Structural: atoms, #, AND arrangement of bonds; ex 

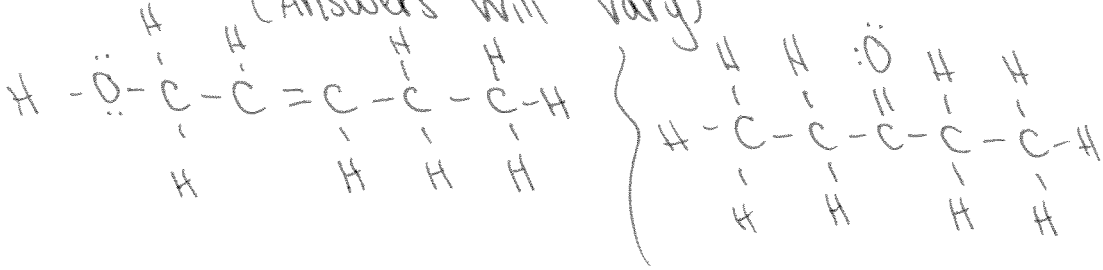
5. Draw 3 isomers of hexane, C_6H_{14}.

(Answers may vary) Isomer: same molecular formula but different structural formula



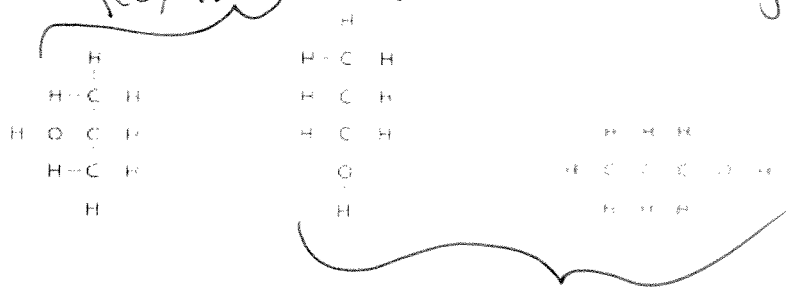
6. Draw 2 isomers of $C_5H_{10}O$

(Answers will vary)



7. Are the following molecules isomers? Why or why not?

Yes, isomers : different arrangements



these two are the same structure

8. Two molecules have the same molecular formula yet one smells sweet and the other smells putrid. Explain how you think this might be possible.

They are isomers.
Sweet has ester functional group; O_2 in middle of molecul
Putrid has carboxylic acid functional group

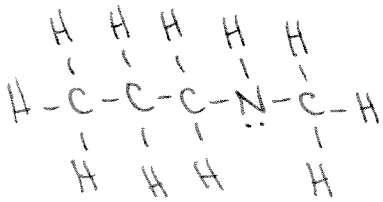
LESSON 3: Bonding Tendencies

9. What is the HONC1234 rule?

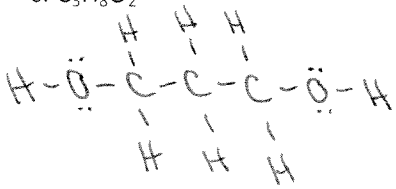
H: forms 1 bond
O: forms 2 bonds
N: forms 3 bonds
C: forms 4 bonds

10. Draw structural formulas for the following molecules, using the HONC1234 rule. (Answers may vary)

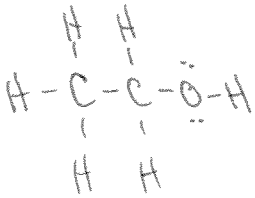
a. $C_4H_{11}N$



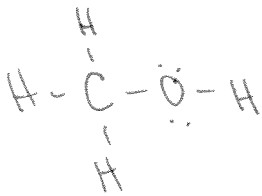
c. $C_3H_8O_2$



b. C_2H_6O



d. CH_4O



LESSON 4: Lewis Dot Symbols

11. What does a Lewis dot structure of a molecule show?

* Valence e⁻ as dots
* Sharing of pairs of e⁻ between atoms
* bonded pairs and lone pairs

12. a)Draw the Lewis dot symbols for the following elements: (Group # indicates # valence e⁻)

a. H b. N c. P d. F e. As

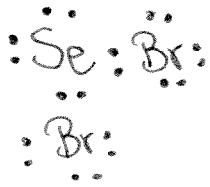
b) How many bonds will each element above form?

a) 1 b) 3 c) 3 d) 1 e) 3

* Look for single, unpaired electrons. Bonds form there

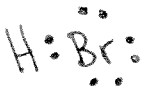
13. Draw Lewis dot structures for the following molecules. Determine how many lone pairs and bonding pairs of electrons are in each.

a. $SeBr_2$



(2 bonded, 8 lone)

b. HBr

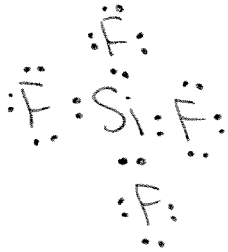


(1 bonded, 3 lone)

c. PF_3

(3 bonded, 10 lone)

d. SiF_4



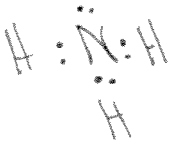
(4 bonded, 12 lone)

LESSON 5: Octet Rule

14. What is the octet rule?

Atoms bond in order to get 8 valence e⁻ (except H, needs 2) to be stable like the noble gases

15. Draw a Lewis dot structure for NH_3. Draw a structural formula for H_2O, including lone pairs.



16. Draw the structural formula for HCN, making sure it follows the octet rule.

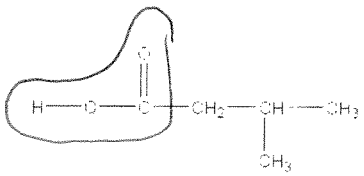
17. What is a double bond? A triple bond?

* Double : sharing of 2 pairs of electrons between atoms
ex :Ö=Ö: -OR- :Ö::Ö:

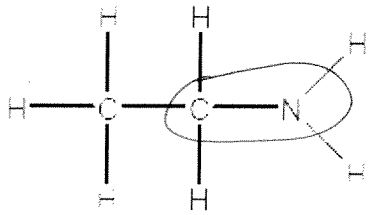
* Triple: sharing of 3 pairs of electrons between atoms ex N≡N

LESSON 6: Functional Groups

18. In the molecules below, circle the functional group, name the functional group, and determine the smell of the molecule, and write the molecular formula.

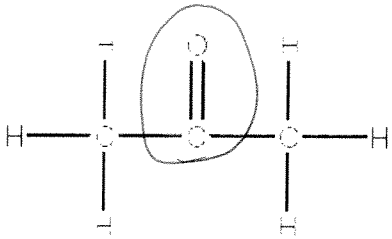


a.

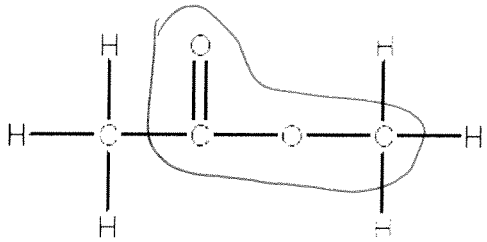


b.

c.



d.



a) carboxylic acid
putrid
$C_5H_{10}O_2$

b) amine
fishy
C_2H_7N

c) Ketone
minty
C_3H_6O

d) ester
sweet
$C_3H_6O_2$